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(71) Applicant and

(72) Inventor: **BUTTLE, Ritchie, James** [ZA/ZA]; 8 Mistral Mews, Flufftail Close, Somerset Ridge, Somerset West, Western Cape Province, 7130 Aouth Africa (ZA).

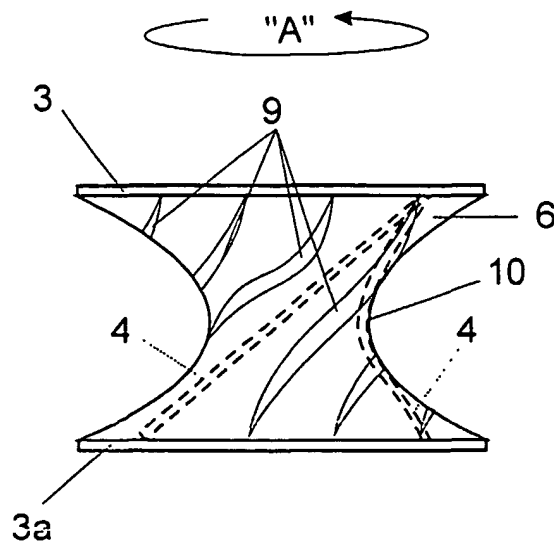
(74) Agent: **VON SEIDEL, Michael**; 10 Leccino Terrace, Bakkershoogte, Western Cape Province (ZA).

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(54) Title: A COLLAPSIBLE TUBULAR STRUCTURE



(57) Abstract: A collapsible tubular structure (1, 22) is provided comprising a peripheral, generally circular, end frame (2, 11, 12, 28, 32) at each end of the structure in the erected condition, at least two and generally three or four angularly spaced, rigidly flexible, longitudinal frame members (4, 15, 29, 33) extending between the two end frames, and a flexible side wall (6, 19) having end edges held in association with each of the two end frames. The structure is characterized in that the ends of the longitudinal frame members are held in association with the end frames in an articulated manner and in that retaining means are provided for releasably holding the elongate frame members in the erected condition relative to the end frames. The length of the longitudinal frame members is of the same order as, or less than, the effective cross-sectional dimension of the tubular structure and this enables the structure to be collapsed by rotating the one end frame relative to the other with consequent pleating of the sidewall between the two end frames; possible bowing of the longitudinal frame members; and collapsing of the container to a position in which the elongate frame members extend approximately diametrically across the juxtaposed end frames.

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## A COLLAPSIBLE TUBULAR STRUCTURE

### 5 FIELD OF THE INVENTION

This invention relates to a collapsible tubular structure and, more particularly, to a tubular structure having a sidewall made of flexible sheet material supported on a supporting frame therefor.

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The tubular structure may have the sole purpose of serving as a display with advertising material or graphics, or both, applied to the outside of the side wall or it may have the purpose of serving as a container for retaining articles therein, optionally by way of a liner bag typically made of impervious plastics material. It may also optionally have a bottom and a lid.

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The tubular structure may have a sidewall that is continuous and optionally impervious or it may have a side wall made of a suitable netting or mesh material both of which are intended to be included within the term flexible sheet material as used herein.

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### BACKGROUND TO THE INVENTION

There is a wide range of uses for a collapsible tubular structure of significant size that is generally not required for permanent use in any one location, and more particularly, a structure that is of light weight and easily movable and transportable. Such uses, as indicated above, include the use of the outer surface of the sidewall of such a structure for the purpose of advertising or displaying other information, or providing the outer surface with an appearance having some other significance. In this application the structure may be required for use intermittently, for example, at sports or other public events that are convened from time to time in different locations.

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Relatively large, light weight and conveniently portable collapsible containers are also often required from time to time at different locations for numerous purposes in amongst others for simply confining a number of objects, for example plastic balls, toys, and many other different, generally light weight items to prevent them from becoming distributed over an area.

Such containers are also often used for retaining refuse in which case the container may be used to support an impervious removable liner bag, if required.

10

Other uses for such collapsible tubular structures, particularly in the form of containers, may be found in stores and storage depots in order to retain particular items of stock in a neat and orderly manner either whilst on display in areas accessible to customers or whilst in storage. Such containers may only be required intermittently, as and when stock of such items is available, and it is advantageous that the structures be collapsible in a swift and easy manner for storage and possible transport.

15

Numerous different types of collapsible structures have been made in the past for one or more of the above purposes and each of these has its own advantages and disadvantages. In most cases, if not all, some components of the structure must be removed or disengaged from others in order to collapse the structure and in many cases separate components must be stored thus leading to the possibility of not all required components being available when the structure must be re-erected.

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## OBJECT OF THE INVENTION

It is an object of this invention to provide a collapsible tubular structure that can be configured to serve a variety of the functions indicated above, or any other appropriate function, wherein the structure is collapsible in a particularly easy and swift manner.

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## SUMMARY OF THE INVENTION

In accordance with this invention there is provided a collapsible tubular structure comprising a peripheral end frame at each end of the structure in the erected condition, at least two angularly spaced elongate frame members  
5 extending between the two end frames, and a flexible side wall having end edges held in association with each of the two end frames, the structure being characterized in that the ends of the elongate frame members are held in association with the end frames in an articulated manner; in that the length  
10 of the elongate frame members is of the same order as, or less than, the effective cross-sectional dimension of the tubular structure; and in that retaining means are provided for releasably holding the elongate frame members in the erected condition relative to the end frames, the arrangement being such that relative rotation of the two end frames about an axis of the  
15 tubular structure causes axial collapsing or erecting of the structure as the case may be.

Further features of the invention provide for the retaining means, in appropriate cases, to be simply a rigidly flexible characteristic of the elongate  
20 frame members that tend to bow during rotation of the two end frames to erect or collapse the structure or, in the alternative, or in addition, the for the retaining means to include resilient connectors that connect the elongate frame members to the end frame members; for the collapsible tubular structure to be of generally circular shape in cross-section in which case the  
25 end frames are conveniently in the form of circular frame members; for the end frame members to be effectively endless and of optionally light weight but, in any event, of substantially rigid construction, for example, by being made of fibre reinforced synthetic resin material, an aluminium material, or a suitable steel; and for the elongate frame members to be made either of fibre  
30 reinforced synthetic resin material exhibiting appreciable rigidity but being adequately resiliently flexible, or of a suitable spring steel material.

Still further features of the invention provide for the sidewall to be of a light weight flexible woven synthetic fabric material or a synthetic netting or mesh material; for there to be three or four equally angularly spaced elongate frame members that are straight in their unstressed condition; for the  
5 elongate frame members to extend, in the erected condition of the structure, in a direction parallel to the axis of the structure; for the end frame members to be enclosed within a fabric sheath either formed from a separate piece of sheet material and stitched to the end of the sidewall or formed as a doubled over hem to the end of the sidewall; for one end, the operatively lower end of  
10 the structure, to be provided with an end wall thereby rendering the structure a container; for the other end, the operatively upper end of the structure, to be provided with a lid; for the elongate frame members to be substantially unattached to the sidewall between said ends; and for the sidewall to be located on the outside of the elongate frame members.

15

An articulated attachment of the ends of the elongate frame members can be achieved in a variety of different ways. One alternative is that each of the elongate frame members be optionally enclosed within a fabric sheath arrangement that is attached at each end to a fabric sheath enclosing the  
20 end frame members or to the ends of the sidewall, or both. Another alternative is for the end frame members to have a formation around which the ends of the elongate frame members are bent to form eyes to thereby create an articulated attachment. A further, and presently preferred alternative is for the ends of the elongate frame members to be provided with  
25 connectors that attach the ends to the end frame members in said articulated manner. Such fittings may assume many different forms, one of which is described in more detail below.

A structure as defined above can have a significant size and accordingly  
30 wind resistance. Thus an operatively lower end can be provided with eyelets, tabs, or loops whereby such lower end can be attached to a supporting

surface, in particular the ground, for example using spring steel tent pegs or the like.

Also, structures in the form of containers can be configured for special application such as, for example, a container having a sidewall and bottom made of netting that can be suspended in an operative position and wherein the bottom can be provided with an elasticized aperture through which articles can be removed from the container as and when required.

10 In order that the invention may be more fully understood, different embodiments thereof will now be described with reference to the accompanying drawings.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

15

In the drawings:-

Figure 1 is an isometric view of one embodiment of structure according to the invention in the form of a container in the erected condition;

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Figure 2 is an elevation of the container illustrated in Figure 1 in the fully erected condition;

25 Figure 3 is an elevation of the container in an early stage of it being collapsed;

Figure 4 is an elevation of the container in a more advanced stage of it being collapsed;

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Figure 5 is an elevation of the container in a fully collapsed condition

Figure 6 is an exploded isometric view illustrating a second embodiment of the invention having an alternative method of construction of the structure;

5 Figure 7 is an isometric view of a container of the type illustrated in Figure 6 in the assembled condition and fitted with a lid;

Figure 8 is a perspective view illustrating the frame of a third embodiment of the invention;

10

Figure 9 is an enlarged illustration of the connection of one elongate frame member to an end frame member;

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Figure 10 is an enlarged elevation of such a connection that includes a plastics moulded fitting; and,

Figure 11 is a cross-section taken through the fitting illustrated in Figure 10.

## 20 DETAILED DESCRIPTION WITH REFERENCE TO THE DRAWINGS

In the embodiment of the invention illustrated in Figures 1 to 5 of the drawings, an operatively upright container, of right circular cylindrical shape, as generally indicated by numeral (1), typically has a height of from about  
25 500 mm to about 1,5 metres, and, in this case about 1,0 metre, in the erected condition illustrated in Figures 1 and 2. In this embodiment of the invention the diameter of the container is substantially the same as its height, namely 1,0 metre.

30 The container has an endless circular, substantially rigid end frame member (2) at both the operatively upper and lower ends and in each case the frame member is enclosed in a fabric sheath (3) stitched closed. The end frame

members are, in this particular instance, light in weight and may be made of fibre reinforced plastics material or, alternatively, a material such as aluminium, or a suitable steel, in particular a corrosion resistant steel.

- 5 The two end frame members are attached to each other by means of four equally angularly spaced elongate frame members (4) each of which is also enclosed within a fabric sheath (5) with the fabric sheath being secured to the fabric sheath (3) enclosing the end frame members. This is achieved in a manner ensuring that the connection between the elongate frame members  
10 and the end frame members is an articulated connection enabling them to hinge freely by virtue of the flexibility of the connecting fabric whilst locating the ends of the elongate frame members relative to the end frame members.

- These elongate frame members are rigidly flexible to enable the collapsing  
15 procedure described below to take place and would typically be made of a fibre reinforced plastics material or a suitable spring steel material. Such flexibility, in this embodiment of the invention, constitutes the said retaining means that serve to retain the elongate frame members at substantially right angles to the end frames in the erected condition. In the erected condition of  
20 the container the elongate frame members are thus straight and extend substantially parallel to the axis of the container.

- The container has a sidewall (6) of highly flexible, light-weight woven or knitted synthetic fabric material such as a suitable polyester or nylon fabric  
25 material. The tubular sidewall is stitched at each end to the sheath that encloses the associated end frame member. As indicated above, the sheath could, alternatively, be formed as a hem at the end of the sidewall. Apart from these attachments to the sheath of the end frame members, the sidewall is made in this embodiment of the invention, unattached relative to  
30 the elongate frame members or sheaths enclosing same in order to provide the freedom of movement necessary to allow the collapsing procedure described below to take place. It should be noted that, if required, and if the



flexibility of the fabric material is appropriate, the elongate frame members could be attached to the sidewall at spaced positions along the length thereof or it could even be received in pockets and extend longitudinally along the sidewall in the erected condition.

5

It should be noted that, in this embodiment of the invention, it is important for the sidewall to be a close fit around the composite frame as, if it is loose, the container may collapse from the erected condition or, alternatively, may not stand sufficiently rigidly upright.

10

The container, in this case, also has a bottom wall (7) stitched at its periphery to the sheath (3a) that encloses the operatively lower end frame member. Also, as indicated above, the structure of this invention has many applications that do not require a bottom wall such as, where the sidewall is used simply for the significance of the appearance of its external surface that may display advertising material, or in instances in which it is used to support removable refuse bags that themselves provide the necessary end closure and do not require any additional bottom to the container.

15

Finally, the sheath (3a) at the operatively lower end of the container has, conveniently located in the region of the lower end of each elongate frame member, a loop (8) of tape whereby the lower end of the erected container can be anchored to the ground using pegs, typically spring steel tent pegs.

25 The container described above can be extremely easily collapsed and erected, as may be required and as described below.

By way of example, collapsing the container from the erected condition illustrated in Figures 1 and 2, involves the simple anchoring of the lower end frame member, for example, by standing on it, and rotating the upper end frame member about the axis of the container, say in an anticlockwise direction as indicated by arrow "A". This has the effect illustrated

30

- progressively in Figures 3, 4 and 5, of causing the container to initially start collapsing axially at the same time as pleats (9) start to form in the sidewalls due to the twisting of the cylindrical sidewall. As this takes place, the elongate frame members bow inwards under the force imposed on them by the tightening of the flexible sidewall as it twists to draw the central region (10) into a waisted configuration. This bowing of the elongate frame members increases until such time as the container is about half collapsed as illustrated in Figure 4.
- Further rotation of the upper frame member (that may now take place automatically due to the resilience of the elongate frame members and their tendency now to straighten) results in the entire sidewall becoming twisted through almost 180 degrees at which stage the elongate frame members are substantially straight once more, due to their resilience, and extend approximately diametrically across the now and generally superimposed end frame members in the fully collapsed condition of the container illustrated in Figure 5.

- It will be understood that erecting the container from the collapsed condition illustrated in Figure 5 is achieved by rotating the upper frame member in an opposite direction relative to the lower frame member.

- In each case the resilience of the elongate frame members, from a position in which the container is roughly half erected or collapsed, will generally automatically move the container to the fully erected or collapsed condition, as the case may be. This results, in particular, from the fact that the height and diameter of the container are approximately the same.

- In the event that the height and diameter of the container are appreciably different, and in particular the height is less than the diameter, there may be a distinct bias towards a tendency for the container to move towards either the erected or collapsed condition. In such an instance the retaining means

would be different and could be resilient connectors attaching the elongate frame members to the end frames very much along the lines described below with reference to Figures 10 and 11. In other cases it may be necessary to provide clips or other means for maintaining it in a fully erected or collapsed  
5 condition.

As indicated above, the material from which the sidewall is made can be varied widely and may indeed be a net or mesh material. Also the number of elongate frame members may be varied and, indeed, as few as two elongate  
10 frame members may prove to be sufficient in certain applications. It is also envisaged that other cross-sectional shapes of tubular structure may operate effectively according to the invention and, in particular, tubular structures of elliptical and polygonal cross-section are envisaged.

15 Also, the construction of the tubular container described above may be varied widely and one variation that is presently regarded as being particularly convenient from a limited run point of view, is illustrated in Figure 6. In this instance, the two circular end frame members (11) and (12) are each enclosed in a sheath (13) and (14) as described above. However, each of  
20 the elongate frame members (15) is introduced into tubular fabric sheath (16) having one end stitched, in this case, to the lower end frame member sheath (14). The elongate frame members (15) are introduced into the tubular fabric sheaths (16) from an open end (17) thereof opposite the frame member. This fabric may be a lightweight fabric such as a woven cotton material. The  
25 free ends (17) of these fabric sheaths (16) are simply folded over and are introduced longitudinally into larger, stiffer and wear resistant outer sheaths (18) stitched to the sheath (13) of the other end frame member (11).

A separately made flexible sidewall (19) is introduced over the assembled  
30 frame and the ends (20) of the sidewall are folded over the end frames and releasably fastened upon themselves using fastener tapes (21) conveniently of the hook and loop type such as those sold under the trade name

"VELCRO". Slide fasteners could be used in the alternative but are not preferred because of the lack of adjustability. The sidewall assembly then maintains the sheathed longitudinal frame members within the outer sheath without any other attachment being necessary.

5

Figure 7 illustrates a container (22) fitted with a lid (23) that can simply comprise flexible sheet material supported by a peripheral frame member (24) that fits over the upper end frame member (25). The lid can conveniently be held in position by two diametrically opposed flexible webs (26) one of which can serve as a hinge and the other to hold the lid closed. Each of the webs has at least one press stud (27) or other fastener to releasably attach it to the sidewall as and when required.

Figures 8 and 9 illustrate a simplified frame assembly that is devoid of any particular sheaths for the end frame members (28) and longitudinal frame members (29) that in this case are conveniently made of steel and spring steel respectively. The steel can be coated in order to provide it with suitable corrosion resistance or it can be inherently corrosion resistant such as a being made of suitable stainless steel. It will be understood that the longitudinal frame members will, of course, be made of spring steel.

In this embodiment of the invention the ends (30) of the spring steel longitudinal frame members can simply be formed into eyes that surround the U-shaped formation (31) in the end frame member (28) that simply serves to locate the end of the longitudinal frame member at its specific circumferential position relative to the end frame member. The arrangement is such that the joint is articulated, as indicated above, and the erecting and collapsing movements are suitably enabled. In this embodiment of the invention the sidewalls are preferably a simple tubular structure as described with reference to Figure 6 and the ends are simply doubled over the end frame members as in that case. Clearly, there are suitable cut out zones where the

longitudinal frame members join with the end frame members to enable the required articulated movement to take place.

Figures 10 and 11 illustrate yet a further alternative connection between the end frame members (32) and longitudinal elongate frame members (33) utilizing special moulded plastics or rubber connectors (34). In this case each connector has a clip (35) formed at one end to clip laterally and optionally irreversibly onto the end frame member such that the clip is able to rotate around the end frame member axis. An integral neck (36) attaches the clip to an integral socket (37) having its axis at right angles to the axis of the clip (35). The socket operatively receives a cap (38) that is rotatable relative to the socket and that in turn receives the end of the longitudinal elongate frame member (33). The frame member can thus rotate about its own axis. Conveniently the cap has a peripheral ridge (39) at its inner end that engages in a cooperant groove in the inner end of the socket to maintain the cap captive yet rotatable relative to the clip.

The clip is located and prevented from moving longitudinally along the end frame member by a pair of stops (40) fixed to the end frame member to cooperate with the clip and maintain it in its peripheral position on the end frame member. The stops can assume any suitable form and are preferably configured so as to be introduced onto the end frame member laterally rather than needing to be threaded onto it. Each stop could thus be a circlip engaging in a peripheral groove in the outer surface of the end frame member; a split pin passing through a hole drilled through the end frame member; or even a spring clip of the nature of a self locking spring washer that has an inch that bite into the end frame member.

The material from which such connectors (34) are moulded may be selected according to be the design of the neck such that the neck provides limited universal movement of the socket axis relative to the clip, as indicated by

arrows "A", to enable the collapsing and erecting movements described above to take place.

It will be understood that connectors of this type have an added advantage in  
5 that the neck can be designed to be rigidly resilient so as to hold the longitudinal elongate frame members at right angles to the end frame members in the erected and fully collapsed conditions. This bias towards a condition in which the socket is at right angles to the axis of clip will tend to hold the tubular structure upright in the erected condition or fully collapsed  
10 condition, as the case may be and may, in some instances, serve as the sole retaining means.

The invention therefore provides an extremely simple and versatile collapsible tubular structure that may be constructed in many different ways  
15 and may assume many different forms, such as that of a container, but in any event, a structure that can be erected and collapsed extremely rapidly and simply and that occupies a minimum amount of space for transport and storage purposes.

**CLAIMS:**

1. A collapsible tubular structure (1, 22) comprising a peripheral end frame (2, 11, 12, 28, 32) at each end of the structure in the erected condition,  
5 at least two angularly spaced elongate frame members (4, 15, 29, 33) extending between the two end frames and a flexible side wall (6, 19) having end edges held in association with each of the two end frames, the structure being characterized in that the ends of the elongate frame members are held in association with the end frames in an articulated manner;  
10 in that the length of the elongate frame members is of the same order as, or less than, the effective cross-sectional dimension of the tubular structure; and in that retaining means are provided for releasably holding the elongate frame members in the erected condition relative to the end frames, the arrangement being such that relative  
15 rotation of the two end frames about an axis of the tubular structure causes axial collapsing or erecting of the structure as the case may be.
2. A collapsible tubular structure as claimed in claim 1 in which the retaining means, in appropriate cases, is a rigidly flexible characteristic  
20 of the elongate frame members that tend to bow during rotation of the two end frames to erect or collapse the structure.
3. A collapsible tubular structure as claimed in either one of claims 1 or 2 in which the retaining means includes resilient connectors (34) that  
25 connect the elongate frame members (33) to the end frame members (32) and provide sufficient flexibility to enable collapsing and erection of the structure to take place.
4. A collapsible tubular structure as claimed in claim 3 in which the  
30 connectors each have a clip (35) formed at one end for lateral attachment to an end frame member.

5. A collapsible tubular structure as claimed in either one of claims 3 or 4 in which an end of each longitudinal frame member (33) is received in a socket (37) formed in an end region of the connector remote from the end frame member (32).
- 5 6. A collapsible tubular structure as claimed in any one of the preceding claims in which the structure is of generally circular shape in cross-section in which case the end frames are in the form of circular frame members.
- 10 7. A collapsible tubular structure as claimed in any one of the preceding claims in which the end frame members are endless and of substantially rigid construction.
- 15 8. A collapsible tubular structure as claimed in either one of claims 1 or 2 in which the longitudinal frame members are made of a spring steel attached at each end to the end frame members in an articulated manner (30, 31).
- 20 9. A collapsible tubular structure as claimed in any one of the preceding claims in which there are three or four equally angularly spaced elongate frame members that are straight in their unstressed condition.
- 25 10. A collapsible tubular structure as claimed in any one of the preceding claims in which the end frame members (2) are each enclosed within a fabric sheath (3) either formed from a separate piece of sheet material and stitched to the end of the sidewall or formed as a doubled over hem to the end of the sidewall.
- 30 11. A collapsible tubular structure as claimed in any one of claims 1 to 9 in which the end frame members (11) are each enclosed within a doubled



over portion (20) of the end of the sidewall (19) that is of fastened upon itself by a releasable fastening means (21).

- 5 12. A collapsible tubular structure as claimed in any one of the preceding claims in which each of the longitudinal frame members is enclosed within a fabric sheath arrangement that may be attached at each end to the fabric sheath enclosing the end frame members or to the ends of the sidewall, or both.
- 10 13. A collapsible tubular structure as claimed in any one of the preceding claims in which one end, the operatively lower end of the structure, is provided with an end wall (7) thereby rendering the structure a container.
- 15 14. A collapsible tubular structure as claimed in any one of the preceding claims in which of the operatively upper end of the tubular structure has a lid (23) associated with it.
- 20 15. A collapsible tubular structure as claimed in any one of the preceding claims in which of the operatively lower end is provided with eyelets, tabs, or loops (8) whereby such lower end can be attached to a supporting surface.

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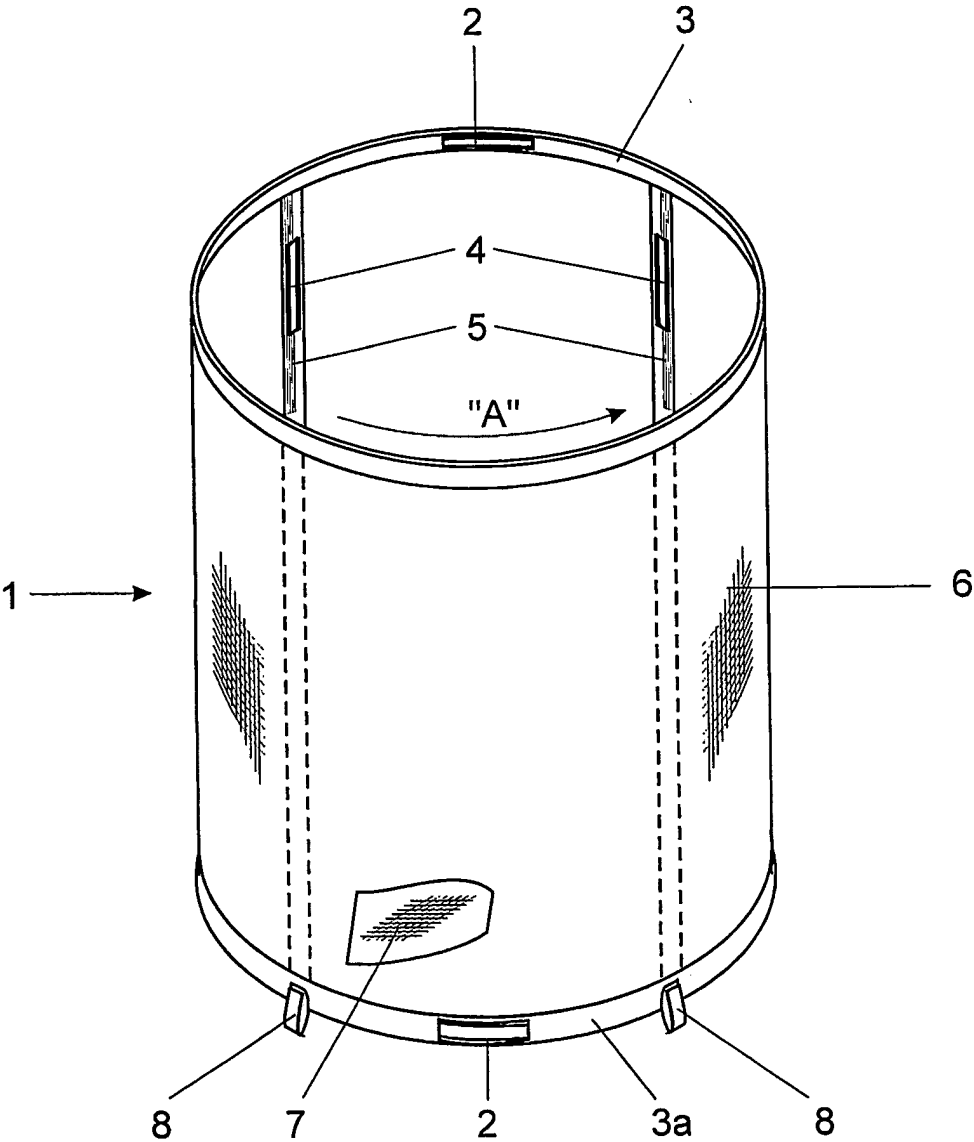


Figure 1

2 / 4

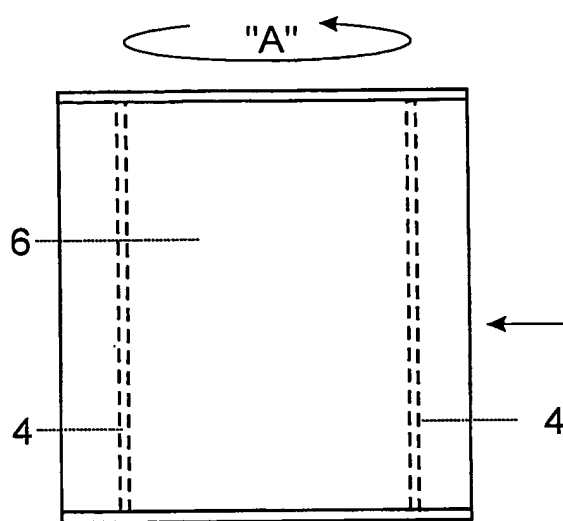


Figure 2

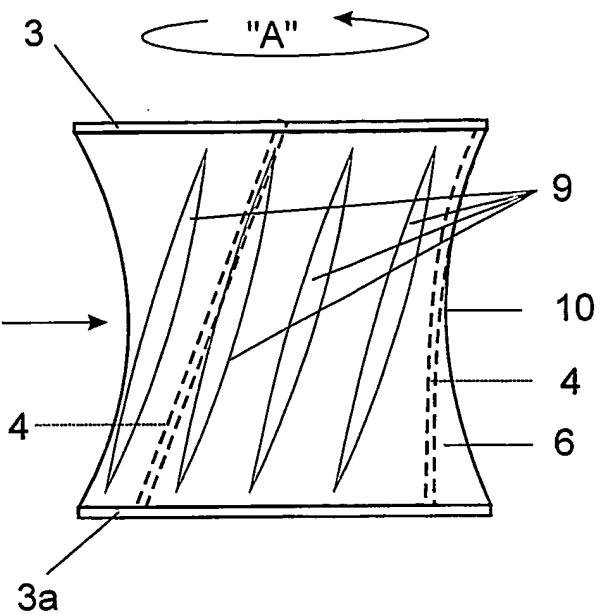


Figure 3

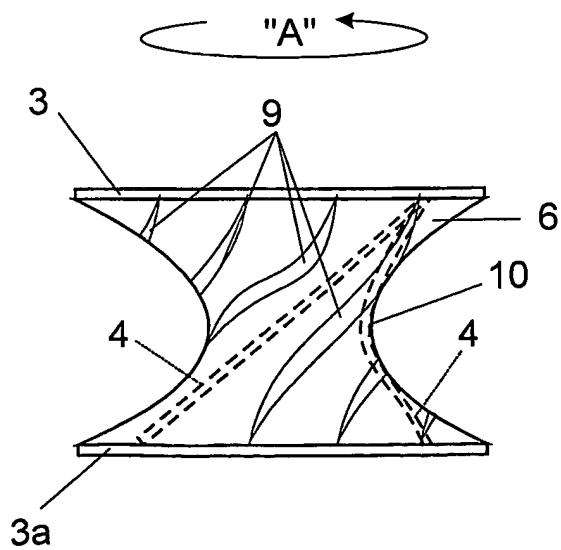


Figure 4

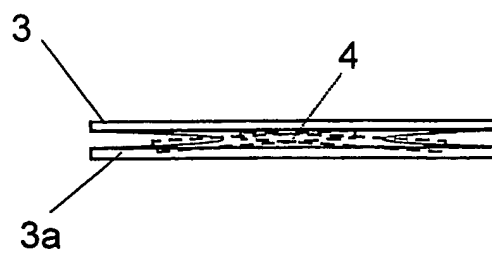


Figure 5

3 / 4

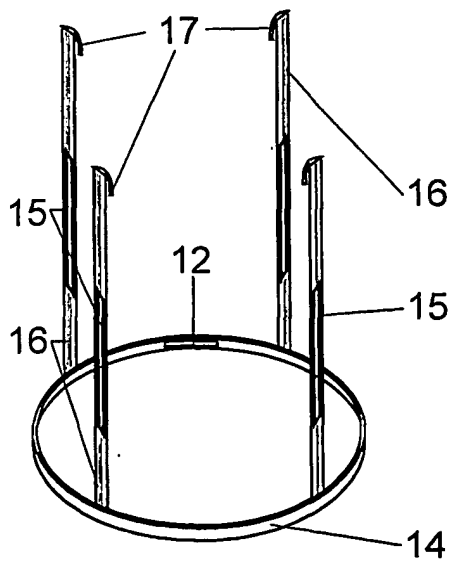
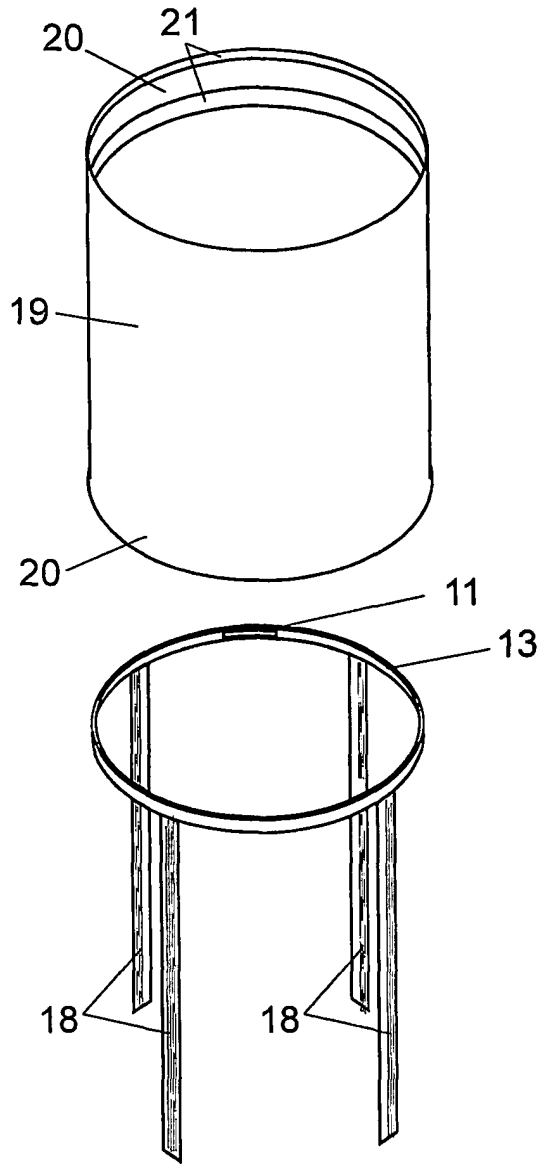


Figure 6

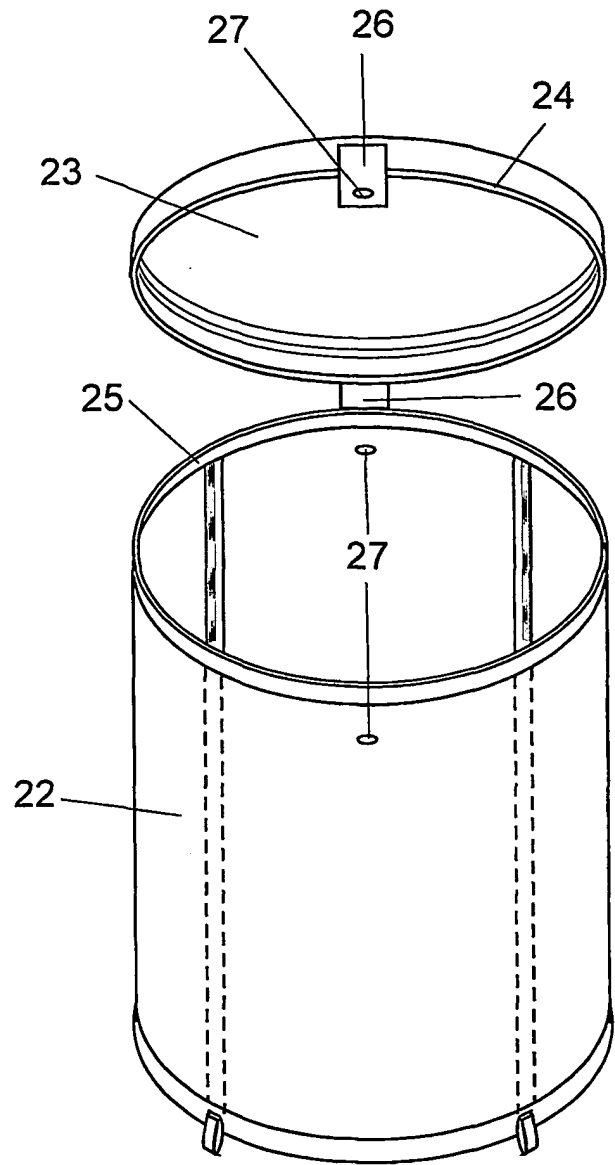


Figure 7

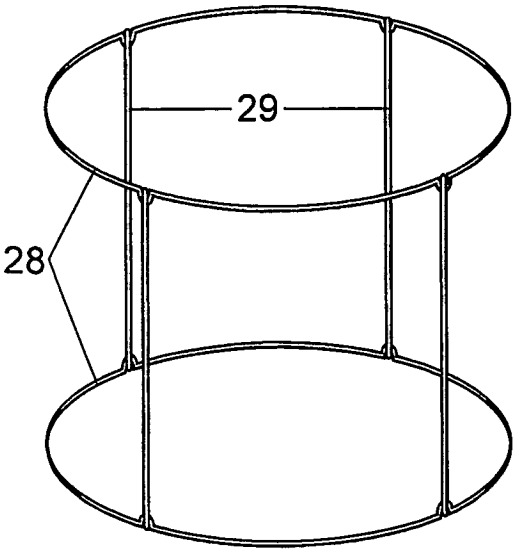


Figure 8

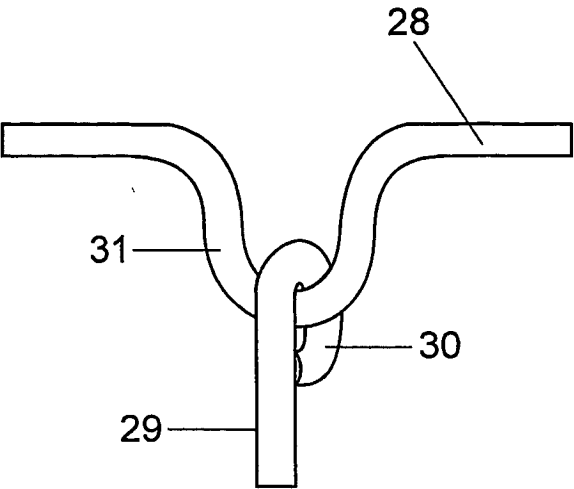


Figure 9

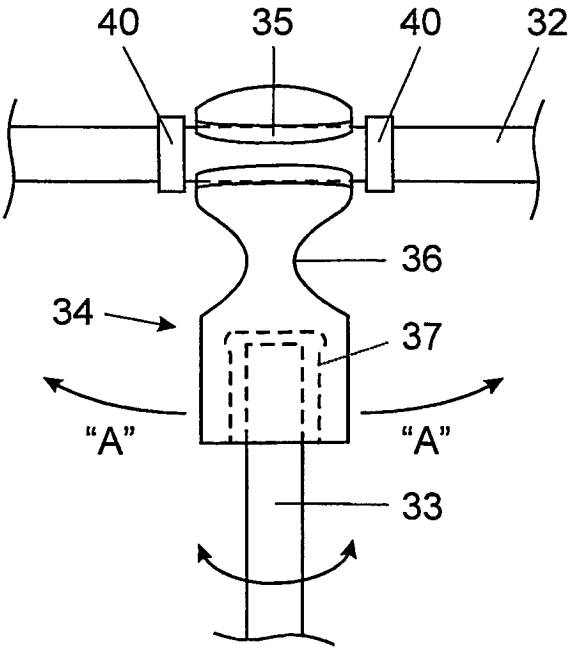


Figure 10

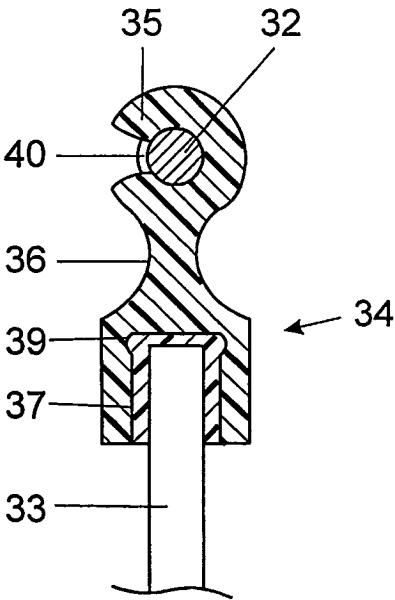


Figure 11

## INTERNATIONAL SEARCH REPORT

PCT/IB 03/02053

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B65D37/00 A47F5/13 A45C7/00 D06F95/00 B65F1/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B65D A47F A45C D06F B65F A47G A01K A63B F16B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 136 376 A (WANG WEN TSAN) 26 September 2001 (2001-09-26)	1,2,9-15
A	column 2, line 51 -column 3, line 57; figures 1-10	3-8
X	DE 35 33 561 A (KOZEL MICHAEL DIPL ING) 16 April 1987 (1987-04-16)	1,2,8,9
X	US 2001/010125 A1 (BIER ROSALIE J) 2 August 2001 (2001-08-02)	1-3,6-9, 13
A	page 4, column 1, line 15 - line 20 page 4, column 2, line 28 - line 29 page 4, column 2, paragraph 6 -page 5, column 1, paragraph 1 page 5, column 2, paragraph 6; figure 1	4,5, 10-12
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the International search

13 August 2003

Date of mailing of the International search report

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

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## INTERNATIONAL SEARCH REPORT

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 26, 1 July 2002 (2002-07-01) & JP 2001 245571 A (SHIMANO INC), 11 September 2001 (2001-09-11) abstract ---	1,2,6,7, 9,13
P,X	GB 2 377 691 A (CHYUAN HAU IND CO LTD) 22 January 2003 (2003-01-22) the whole document ---	1,2,9-13
A	FR 1 332 686 A (LORBA) 19 July 1963 (1963-07-19) figures 1-5 -----	4,5

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US 2001010125	A1	02-08-2001	US 6212792 B1	10-04-2001
JP 2001245571	A	11-09-2001	NONE	
GB 2377691	A	22-01-2003	NONE	
FR 1332686	A	19-07-1963	NONE	